COURSE OVERVIEW EE0060
LV/MV/HV Circuit Breakers and Switchgears
Specification, Design, Operation, Inspection, Testing, Maintenance, Repair & Troubleshooting

Course Title
LV/MV/HV Circuit Breakers and Switchgears: *Specification, Design, Operation, Inspection, Testing, Maintenance, Repair & Troubleshooting*



Course Date/Venue
Session 1: January 17-21, 2027/Meeting Plus 9, City Centre Rotana Doha Hotel, Doha, Qatar
Session 2: December 19-23, 2027/Meeting Plus 9, City Centre Rotana Doha Hotel, Doha, Qatar

3.0 CEUs (30 PDHs) AWARD

Course Reference
EE0060

Course Duration/Credits
Five days/3.0 CEUs/30 PDHs

Course Description






This practical and highly-interactive course includes real-life case studies and exercises where participants will be engaged in a series of interactive small groups and class workshops.

This course is designed to update participants with the latest development of Circuit Breakers and to present some of the more common and updated aspects of low, medium and high voltage switchgear maintenance. It must be understood that there is an incredible variety of equipment used on low, medium and high voltage switchgear today. Switchgears play an important role in the protection, distribution and control of electrical power in manufacturing or power plant and in a utility distribution system. Negligent maintenance practices can lead to power system inefficiency and loss of system reliability

An older plant may have switchgear that was built in the forties in the older areas and modern switchgear in other areas as the plant was upgraded. This course will present maintenance problems to the maintenance manager and technician. Newer plants will probably have modern equipment of a limited variety and manufacture. It is these similarities that will be covered in the course.

Course Objectives/Outcomes & Benefits for the Participants

Upon the successful completion of this course, each participant will be able to:-

- Specify, design, operate, inspect, test, maintain, repair and troubleshoot circuit breakers and switchgears
- Apply an in-depth knowledge and skills on LV/MV/HV circuit breakers and switchgears
- Describe the switchgear details such as ratings, degree of protection, service conditions and ancillary equipment
- Explain switchgear asset management including CBM and RCM process, tripping devices, maintenance and testing
- Apply load and fault calculation to decide the task of protection system and the operating conditions of power system
- Explain circuit breaker control circuits, types and application of protective relays, structure of control circuits and the use and application of current and voltage transformers
- Discuss circuit breaker characteristics in relation to protection control circuits, selectivity, sensitivity and speed of the control circuits
- Recognize the value of earthing system to protection control circuits and the power system protection as well as fault clearance and power system redundancy through control system application
- Identify the various switchgear diagnostic techniques and employ the different types of substation circuit breaker techniques and determine the switchgear vital equipment including batteries condition and monitoring, relay applications for basic and complex busbar arrangements and zone selection logic
- Employ the substation maintenance techniques and discuss their description, structures, features and functions
- Apply the switchgear maintenance practices and improve maintenance and repair procedures
- Carryout maintenance work orders including their process development, procedures and problems encountered
- Introduce computerized maintenance management systems (CMMS) and recognize its importance in circuit breakers design, inspection, maintenance, repair and troubleshooting

Exclusive Smart Training Kit - H-STK®



*Participants of this course will receive the exclusive "Haward Smart Training Kit" (**H-STK®**). The **H-STK®** consists of a comprehensive set of technical content which includes **electronic version** of the course materials conveniently saved in a **Tablet PC**.*

Who Should Attend

This course provides an overview of all significant aspects and considerations of Circuit Breakers and Switchgears for engineers and other technical staff who need a sound understanding of Low, Medium and High Voltage Switchgear and Circuit Breaker specification, design, operation, inspection, testing, maintenance, repair and troubleshooting.

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course who completed a minimum of 80% of the total tuition hours.

Certificate Accreditations

Haward's certificates are accredited by the following international accreditation organizations:

- British Accreditation Council (BAC)

  Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. Haward's certificates are internationally recognized and accredited by the British Accreditation Council (BAC). BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

- The International Accreditors for Continuing Education and Training (IACET - USA)

  Haward Technology is an Authorized Training Provider by the International Accreditors for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 2018-1 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 2018-1 Standard**.

  Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units** (CEUs) in accordance with the rules & regulations of the International Accreditors for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

  Haward Technology Middle East will award **3.0 CEUs** (Continuing Education Units) or **30 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

Course Instructor(s)

This course will be conducted by the following instructor(s). However, we have the right to change the course instructor(s) prior to the course date and inform participants accordingly:



Mr. Ken Steel is a **Senior Electrical & Instrumentation Engineer** with over **30 years** of extensive experience. His expertise widely covers **Electrical Motors Testing**, **Heat Tracing** & Insulation Installation & Testing, **HV Terminations**, **High & Low Voltages** on Overhead Cranes, **HV/MV Cable Splicing**, **Cable & Over Head Power Line**, **HV/MV Switchgear, HV Cable** Design, **Medium & High Voltage** Equipment, **High Voltage Circuit Breaker** Inspection & Repair, **High Voltage Power** System, **HV Equipment** Inspection & Maintenance, **HV Switchgear** Operation & Maintenance, Resin / **Heat Shrink & Cold Shrink** Joints, **HV/LV Equipment**, **LV & HV** Electrical System, **Cable** Splicing & Termination, **High Voltage** Electrical Safety, **LV**, **MV & HV Cable** Installations & Properties, **LV Substation**, **MV & LV Cable**, **UPS Systems**, **MV & LV** Direct on Line Motor Drives, **MV & LV** VSD Motor Drives, **MV & LV** Soft Starter Motor Drives, **LV Two Speed Motor Drives**, Underground **Transformer Oil Containment Tank**, **Electrical & Instrumentation Construction** Installation, 1500KW, 1000KW, 1752KW **Diesel Power Plant Installation**, **110KV Overhead Line**, **110KV Outdoor Switchgear**, 110KV/10KV 6500KVA **Transformer**, **Transformer Substation**, 1600KVA 10KV/0.4KV & 2 Off 1000KVA **Diesel Generators**, 1600KVA 10KV/0.4KV & 1650KVA **Diesel Generator**, **110KV/35KV/10KV Substation**, 110KV/10KV **Transformers**,110KV & 2 Off 6KV **Overhead Lines**, 34.5KV,13.8KV ,4.16KV & 480V **Switchgear**, 4.16KV & 480V MCC, **Transformers & Motor Drives** Substations, **Diesel Driven Generators**, **Overhead Cranes**, **Overhead Cranes & HVAC Units**, **AC & DC Drives**, **Data Logger**, **Electrical, Instrumentation & Mechanical** Installation Maintenance, Slab Mills, Pre Heat Ovens, Hydraulic Shears, Stamping Machine, Gearboxes, Rollers, Pumps, Valves, Electro Magnets & Pump House Operation, Boilers Construction And Commissioning, Valve Calibration & Testing, Level Gauges, Pressure & Flow Transmitters Installation & Calibration, Pressure & Leak Testing of Boilers, Leak Testing, SMP, Elect, I&C, F&G, HVAC & Utility Services, Nitrogen Leak Test Operations, Steam Blowing Activities, SMP, Elect, I&C, F&G, HVAC & Utility Services, PTW Issue (PA/AC), Installation & Mechanical Piping and Hydro Testing & Leak Testing of Lines Installation.

During Mr. Steel's career life, he has gained his practical experience through several significant positions and dedication as the **3GP PBF & Boilers SC Commission Support, SC Site Execution Superintendent, E&I Construction Superintendent, High Voltage Construction Supervisor, Control & Power Construction Supervisor, Electrical & Instrumentation Supervisor, Electrical Technician, Construction Support Electrical Engineer, E&I Engineer, Electrical/Instrumentation Site Supervisor, Q.A/Q.C Inspector, Electrical/ Instrumentation Technician, Maintenance Fitter Instrumentation Technician, Millwright, Apprentice Millwright and Senior Instructor/Lecturer** for Tengiz Chevron Oil Kazakhstan, Al Jubail Saudi Arabia, Escravos Delta state Nigeria, Lurgi S.A, SuD Chemie Sasol Catalysts, J C Groenewalds Construction (LTA), Tycon (Goodyear S.A.), Dragline Construction and Iscor Vanderbijlpark.

Mr. Steel has a **Diploma** in **Electronics Mechanic**. Further, he is a **Certified Instructor/Trainer** and delivered numerous trainings, courses, workshops, seminars and conferences internationally.

Training Methodology

Our courses employ an interactive, learner-centred methodology that integrates theoretical knowledge with practical application. The training is delivered through a suitable combination of some or all of the following methods, selected according to the course content and learning objectives:

- Instructor-led presentations and facilitated discussions
- Practical workshops and participant presentations
- Hands-on exercises and real-world case studies
- Equipment demonstrations and technical drawings
- Hardware- and software-based simulations
- Gamification & Role Play in soft-skills courses only
- Virtual Reality (VR) and Augmented Reality (AR)
- Instructional videos and other relevant training resources

This blended approach encourages active participation, strengthens practical skills and supports the effective application of acquired knowledge in the workplace.

Learning Design & Customization

This course can be customized to the exact requirements of clients. Haward Technology is so proud of our huge capabilities in tailoring our courses to the training needs of our valued clients.

Accommodation

Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

Course Fee

US$ 6,000 per Delegate+ **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the course for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

Day 1

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Introduction*** *Voltage Convention • Fundamentals of Circuit Breakers • Types of Breakers, Construction • Ratings, Tripping Characteristics*
0930 – 0945	*Break*
1020 – 1120	***Switchgear in a Network Context*** *Single Line • Utilization*
1120 – 1220	***Switchgear in Historical Perspective*** *Oil Circuit Breakers • Air Blast CB • SF6 and Vacuum CB • Operating Mechanisms*
1230 – 1245	*Break*

1245 – 1420	***Switchgear Details*** *Ratings Ur, Ik, Ip, Va • Degree of Protection • Service Conditions • Ancillary Equipment*
1420 – 1430	***Recap***
1430	*Lunch & End of Day One*

Day 2

0730 – 0930	***Switchgear Asset Management*** *Equipment Register • CBM and RCM Process • Switchgear Diagnostic Techniques • Tripping Devices & Maintenance & Testing*
0930 – 0945	*Break*
0945 – 1130	***Circuit Breakers Control Circuits*** *Philosophy, Types & Application of Protective Relays • Control System Structure, Instrument Transformers • Current & Voltage Transformers • Panels, Signalling, Interlocking*
1130– 1230	***Circuit Breakers Control Circuits (cont'd)*** *Typical Connection Diagrams • Primary & Back-up Relaying • Fault Calculation • System Earthing • Circuit Breakers Characteristics • Selectivity, Sensitivity, Speed • Reliability*
1230 – 1245	*Break*
1245 – 1420	***Circuit Breakers Control Circuits (cont'd)*** *Evaluation of Protection Relaying • Setting of Protection • Fault Clearance • Redundant Control Circuits*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Two*

Day 3

0930 – 1015	***Case Study*** *Circuit Breaker Settings • Selectivity, Sensitivity, Speed*
0930 – 0945	*Break*
0945 – 1130	***Circuit Breaker Diagnostic Techniques*** *Diagnostic Techniques*
1130 – 1230	***Switchgear Vital Equipments*** *Batteries Condition and Monitoring • Discussions*
1230 – 1245	*Break*
1245 – 1420	***LV/MV/HV Substation Bus Arrangement, Incoming & Outgoing Circuits*** *Automatic Switching During Normal or Abnormal Conditions, Bus Protection & Circuit Breaker System • Bus Differential & Breaker Failure Relay, Zone Selection Logic & CT Requirements*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Three*

Day 4

0730 – 0930	***Substation Maintenance Techniques*** *Description • Structures • Fuses, Arresters, Switches • Substation Compound • Switchgear Maintenance Practices • Metal Clad Switchgear • Maintenance Details*
0930 – 0945	*Break*

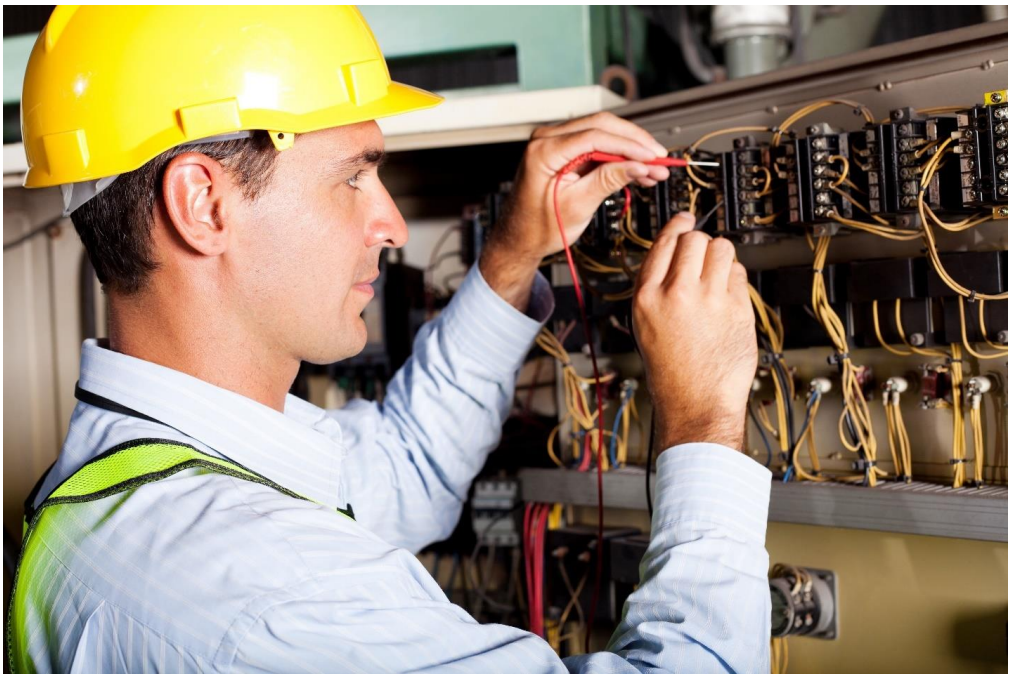
0945 – 1130	***Substation Maintenance Techniques (cont'd)*** *Metal Clad Switchgear Maintenance Details • Discussions*
1130 – 1230	***Substation Maintenance Techniques (cont'd)*** *Maintenance & Repair Fundamentals*
1230 – 1245	*Break*
1245 – 1420	***Substation Maintenance Techniques (cont'd)*** *Maintenance & Repair Procedures*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Four*

Day 5

0730 – 0930	***Maintenance Work Orders*** *Process Development*
0930 – 0945	*Break*
0945 – 1100	***Maintenance Work Orders (cont'd)*** *Procedures*
1100 – 1200	***Maintenance Work Orders (cont'd)*** *Problems Encounters • Samples, Discussions*
1200 – 1215	*Break*
1215 – 1345	***Fundamentals of Computerized Maintenance (CMMS)***
1345 – 1400	***Course Conclusion***
1400 – 1415	***POST-TEST***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

Practical Sessions

This practical and highly-interactive course includes real-life case studies and exercises:-



Course Coordinator

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